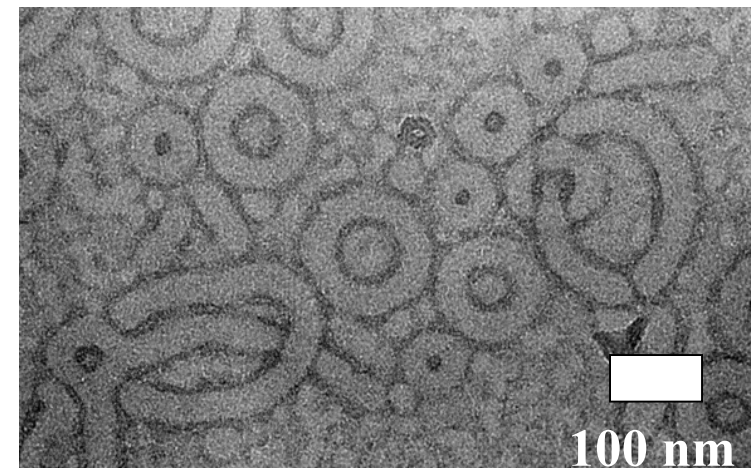
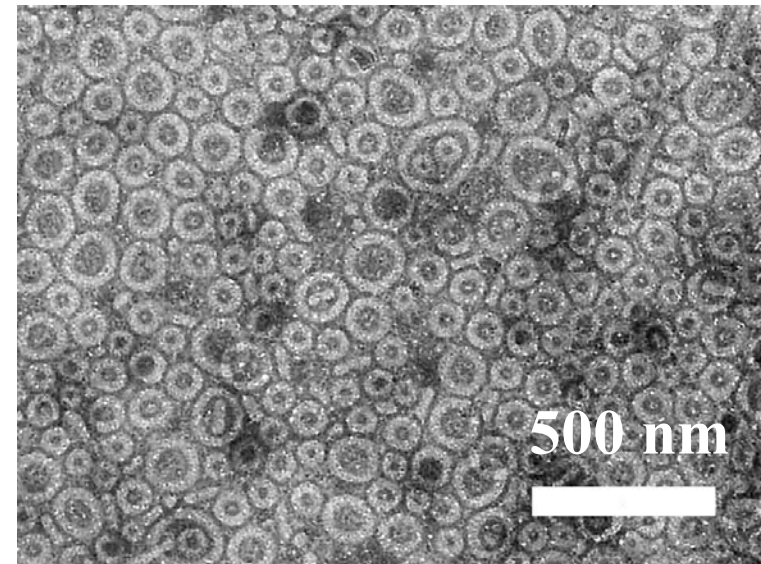


Complexity *via* Self-assembly by Combining Block Copolymers with Biophysics

Darrin J. Pochan, University of Delaware, DMR-0210247
with K. L. Wooley (Washington Univ.)

A stable phase of toroidal micelles has been produced by combining amphiphilic triblock copolymer self-assembly with the biophysical concept of biopolymer counterion valency. By designing triblock copolymers with a carboxylic acid-containing hydrophilic corona block, a low- T_g intermediate block and a glassy hydrophobic terminal block, ring-like micelles have been assembled in aqueous solution in the presence of bis-terminal amines. The toroid formation is akin to what is observed in the toroidal bundling of charged biopolymers such as DNA, for which multivalency of the polymer counterion is critical. The combination of block copolymer design with polyelectrolyte and biopolymer physical principles has advanced the possible complexity available for synthetic molecule self-assembly.

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Education and Outreach: Within the context of the NIRT grant, the Pochan polymer physics/morphology lab is working closely with the Wooley polymer synthesis lab in order to design and self-assemble complex nanostructures. The advance towards explicit biomimicry, such as in the toroidal self-assembly could not have occurred without the close research relationship. Zhiyun Chen from WUSTL spent 1 month in residence in the Pochan lab during January of 2004 in order to work closely with Kelly Hales and Honggang Cui from UD. This visit was critical in determining molecular design parameters and solution processing parameters required for toroid formation in solution. These visits between labs will continue with WUSTL researchers accompanying UD students to visit the National Center for Neutron Research in order to conduct small angle neutron scattering experiments, a technique critical to the characterization of global structure within self-assembled systems.